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V-39, V-40 KLYSTRON OSCILLATORS
DESIGN AND DEVELOPMENT PROGRAM

Progress Report for
Quarter Ending 31 May 1954

Prepared for: Bureau of Ships
Navy Department

On: BuShips Contract No. N0bsr-52105
Index No. NE-112044

By: Robert G. Rockwell

Approved:

SF Varian

Sigurd F. Varian
Vice-President for Engineering

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Page 1 of 4

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PURPOSE

The purpose of the program covered by BuShips Contract No. NObsr-52105 is to design and develop two wide-range klystron oscillators, V-39 and V-40, which will comply with the specifications outlined in this contract.

The two oscillators will cover the frequency band from 10 to 21 kmc. One tube will tune over the lower half of the band from 10 to 15.5 kmc, and the other will cover the band from 15 to 21 kmc. Preliminary design tubes of each type, complete with electrical test and characteristic data, will be furnished. In addition, five tubes embodying the final design of each type will be supplied, along with electrical characteristics and test data, final proposed specifications, and manufacturing drawings.

GENERAL FACTUAL DATA

During this quarter, a mode suppressor design which successfully eliminates the mode interference in the V-39 was perfected. Five V-39's, operating in external cavities incorporating this design, were inspected and accepted by the local Inspector of Naval Material, making a total of nine accepted tubes.

In the V-40 development, a cylindrical choke short for rectangular waveguide was designed and the holes occurring due to the mode suppressor were eliminated. One tube of the final V-40 design was inspected and accepted, thereby providing six accepted tubes.

DETAILED FACTUAL DATA

The first work attempted in this quarter was to eliminate the interfering modes of the V-39 by means of a mode suppressor placed alongside the main tuning cavity. There were 15 variations of mode suppressor tried

Page 2 of 4

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before a design was found which eliminated all detectable interference. This design consisted of a new size and location of the coupling hole to eliminate the $3/2 \lambda$ -mode interference in conjunction with a mode suppressor narrow enough to prevent the λ -mode from being suppressed, and a second, even narrower mode suppressor attached to the opposite side wall with a considerably shorter coupling hole which suppressed the $5/2 \lambda$ -mode interference. A third suppressor was no longer found necessary, but mode-suppressing screw holes have been provided to eliminate some high-frequency modes which appear at the highest beam voltages allowed.

During this quarter, there were five V-39 tubes inspected and accepted by the local Inspector of Naval Material: tubes No. 54, 62, 64, 65, and 66. It was found in these tubes that for a beam voltage as low as about 500 volts, a power output of 50 mw over the tuning range could still be obtained. Consequently, the tubes have been tested with either 500 or 550 volts on the beam.

Delivery of five V-39 tubes will complete the requirements for V-39's on this contract.

In the V-40 development, efforts were concentrated on the design of a cylindrical choke in rectangular waveguide and on elimination of the holes occurring due to the mode suppressor. A V-40 using the cylindrical choke short was tested and found to oscillate from about 21.5 or 22 kmc down to 14.3 kmc.

V-40 tube No. 67 was inspected and accepted by the local Inspector of Naval Material. Manufacturing drawings which will be included in the final report will be of V-40 No. 67, which uniquely includes the cylindrical choke short in the tuning cavity.

V-40 tube No. 54, accepted previously, and tube No. 67 were then re-examined, and it was found that the power output drops below 50 mw when the beam voltage is lowered. The tubes easily attain a power output of over 20 mw at a beam voltage of 650 volts, however.

Page 3 of 4

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A total of six V-40 tubes of the final design (tubes No. 54, 58, 59, 62, 65, and 67) have now been inspected and accepted. Tube No. 58 was shipped in June 1953, and tubes No. 59 and 62 were shipped in December 1953. Delivery of two of the three remaining accepted V-40 tubes will complete the requirements for V-40's on this contract.

A final report of the complete work covered by this program is now in preparation. Delivery of the final report will complete this contract.

CONCLUSIONS

Tubes of the V-39 and V-40 types have now been successfully developed, culminating the work of several months. Delivery of five tubes of each type which will complete the tube requirements on this contract, will take place upon receipt of shipping instructions. A final report covering the work in this program is now being prepared, and submission of this report will complete the contract.

Estimated expenditures during May 1954: \$2,364.00

Estimated man-hours during May 1954: 251

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